

WHAT IS CLAIMED IS:

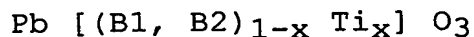
1. An apparatus for non-invasive measurement of living body characteristics, comprising:

a light source configured to generate light containing a specific wavelength component;

an irradiation unit configured to irradiate a subject with the light; and

at least one acoustic signal detection unit including piezoelectric devices formed of a piezoelectric single crystal containing lead titanate and configured to detect an acoustic signal which is generated due to the energy of the irradiation light absorbed by a specific substance present in or on a subject.

2. An apparatus according to claim 1, wherein the piezoelectric single crystal is represented from a general formula



where

$x = 0.05$ to 0.55 ; B1 represents one element selected from the group consisting of Zn, Mg, Ni, Sc, In and Yb and B2 represents one element selected from the group consisting of Nb and Ta.

3. An apparatus according to claim 1, wherein the piezoelectric devices have a transparency to the specific wavelength component of the irradiation light.

4. An apparatus according to claim 3, wherein the acoustic signal detection unit is located between the

irradiation unit and the subject to allow the irradiation light of the specific wavelength component from the irradiation unit to be applied to the subject through the acoustic signal detection unit.

5. An apparatus according to claim 1, wherein, in the acoustic signal detection unit, the piezoelectric devices are arranged on a plane.

6. An apparatus according to claim 1, wherein the acoustic signal detection unit has a transparency of 30% or more to the specific wavelength component of the light.

7. An apparatus according to claim 1, wherein the specific wavelength component falls within a range of 600 to 5,000nm.

8. An apparatus according to claim 3, further comprising a transparent electrode formed on each major surface of the piezoelectric devices, the transparent electrode having a transparency to the specific wavelength component of the light.

9. An apparatus according to claim 1, wherein the acoustic signal detection unit is comprised of a composite structure of the piezoelectric material and resin.

10. An apparatus according to claim 9, wherein the resin is filled in gaps between the piezoelectric devices.

11. An apparatus according to claim 9, wherein the resin has a transparency to the specific wavelength component of the light.

12. An apparatus according to claim 11, wherein the light is applied to the subject after passing through the resin part.

13. An apparatus according to claim 11, wherein the piezoelectric devices have a transparency to the specific wavelength component of the light and the optical refractive index and transmittance of the piezoelectric devices are nearly equivalent to those of the resin.

An apparatus according to claim 1, further comprising a temperature control unit configured to control the temperature of a measurement site of the subject.

14. An apparatus according to claim 1, further comprising a sensor configured to detect contact of the acoustic signal detection unit with the subject.

15. An apparatus according to claim 15, further comprising a mechanism configured to move the acoustic signal detection unit in accordance with a degree of contact detected by the sensor.

16. An apparatus according to claim 1, wherein the plurality of acoustic signal detection units are arranged on a plane.

17. An apparatus according to claim 17, further comprising an optical switch unit configured to direct the irradiation light from the light source to the subject through a plurality of light propagation paths and selectively control those associated light paths relative to the plurality of light propagation paths, the irradiation light position being changed by the switching of the associated light propagation paths by the optical switch unit.

18. An apparatus according to claim 1, further comprising

an optical switch unit configured to allow the irradiation light from the light source to be applied through a plurality of light propagation paths to the subject and selectively control those associated light paths relative to the plurality of light propagation paths, and a moving mechanism configured to move the acoustic signal detection unit according to the change of the light irradiation position which is made based on the switching of the associated light propagation paths by the optical switch unit.

20. An apparatus according to claim 17, further comprising a mechanism configured to move the irradiation unit, the irradiation position of the irradiation light being changed by moving the irradiation unit.

21. An apparatus according to claim 1, further comprising an irradiation unit moving mechanism configured to move the irradiation unit and a detection unit moving mechanism configured to move the acoustic signal detection unit, wherein the detection unit moving mechanism moves the acoustic signal detection unit according to the irradiation position of the irradiation light which is made based on the movement of the irradiation unit by the irradiation unit moving mechanism.

22. An apparatus according to claim 1, wherein the specific substance is glucose and the irradiation light is at least one kind of a given wavelength region corresponding to a portion or a whole selected from a wavelength range of 400 to 2,500nm.

23. An apparatus according to claim 1, wherein the

specific substance is hemoglobin and the irradiation light is at least one kind of light of a given wavelength region corresponding to a portion or a whole selected from a wavelength range of 500 to 1,600nm.

24. An apparatus for non-invasive measurement of living body information, comprising:

- a light source configured to generate light containing a specific wavelength component;

- an irradiation unit configured to emit the light; and

- an acoustic signal detection unit having an optical transparency to the specific wavelength component of the light, arranged between a subject and the irradiation unit and configured to detect an acoustic signal which is generated due to the energy of the light absorbed by a specific substance present in or on the subject, wherein the light emitted from the irradiation unit is applied as irradiation light to the subject through the acoustic signal detection unit.

25. An apparatus for non-invasive measurement of living body information, comprising:

- a light source configured to generate light containing a specific wavelength component;

- an irradiation unit configured to irradiate the light as irradiation light to a subject; and

- an acoustic signal detection unit having a piezoelectric device optically transparent to the specific wavelength component of the light and configured to detect an acoustic signal which is generated due to the energy of the irradiation

light absorbed by a specific substance present in or on the subject.

26. A method for non-invasive measurement of living body information comprising:

outputting light containing a specific wavelength component generated by a light source from an irradiation unit; irradiating a subject with light from the irradiation unit through at least one acoustic signal detection unit including piezoelectric devices formed of a piezoelectric single crystal containing lead titanate; and

detecting an acoustic signal which is generated due to the energy of the light absorbed by a specific substance present in or on the subject by the acoustic signal detection unit.

27. A method for non-invasive measurement of living body information comprising:

outputting light containing a specific wavelength component generated by a light source from an irradiation unit; irradiating a subject with light output from the irradiation unit through at least one acoustic signal detection unit having an optical transparency to the light; and

detecting an acoustic signal which is generated due to the energy of the light absorbed by a specific substance present in or on the subject by the acoustic signal detection unit.

28. A method according to claim 26, further comprising: selecting a desired light propagation path from light propagation paths to change a light irradiation position, the light propagation paths being provided between the light source

and the irradiation unit.

29. A method according to claim 27, further comprising:
selecting a desired light propagation path from light propagation paths to change a light irradiation position, the light propagation paths being provided between the light source and the irradiation unit.

30. A method according to claim 26, further comprising:
selecting a desired light propagation path from light propagation paths to change a light irradiation position, the light propagation paths being provided between the light source and the irradiation unit; and

moving the acoustic signal detection unit according to the changed light irradiation position.

31. A method according to claim 27, further comprising:
selecting a desired light propagation path from light propagation paths to change a light irradiation position, the light propagation paths being provided between the light source and the irradiation unit; and

moving the acoustic signal detection unit according to the changed light irradiation position.

32. A method according to claim 26, further comprising:
moving the irradiation unit to change a light irradiation position.

33. A method according to claim 27, further comprising:
moving the irradiation unit to change a light irradiation position.

34. A method according to claim 26, further comprising:

controlling the temperature of a measurement site of the subject by a temperature control unit.

35. A method according to claim 27, further comprising: controlling the temperature of a measurement site of the subject by a temperature control unit.

36. A method according to claim 26, further comprising: detecting contact of the acoustic signal detection unit with the subject by a sensor.

37. A method according to claim 27, further comprising: detecting contact of the acoustic signal detection unit with the subject by a sensor.

38. A method according to claim 26, further comprising: moving the acoustic signal detection unit in accordance with a degree of contact detected by the sensor or stopping the light irradiation of the irradiation unit.

39. A method according to claim 27, further comprising: moving the acoustic signal detection unit in accordance with a degree of contact detected by the sensor or stopping the light irradiation of the irradiation unit.

40. A method according to claim 26, wherein the plurality of acoustic signal detection units are arranged on a plane.

41. A method according to claim 27, wherein the plurality of acoustic signal detection units are arranged on a plane.

42. An apparatus according to claim 26, wherein the specific substance is glucose and the irradiation light is at least one kind of a given wavelength region corresponding to a portion or a whole selected from a wavelength range of 400 to

2,500nm.

43. An apparatus according to claim 27, wherein the specific substance is glucose and the irradiation light is at one kind of a given wavelength region corresponding to a portion or a whole selected from a wavelength range of 400 to 2,500nm.

44. An apparatus according to claim 26, wherein the specific substance is hemoglobin and the irradiation light is at least one kind of light of a given wavelength region corresponding to a portion or a whole selected from a wavelength range of 500 to 1,600nm.

45. An apparatus according to claim 27, wherein the specific substance is hemoglobin and the irradiation light is at least one kind of light of a given wavelength region corresponding to a portion or a whole selected from a wavelength range of 500 to 1,600nm.